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ABSTRACT

For several decades, school districts have attempted to anticipate and plan for enrollment fluctuations within 5- and 10-year periods. From a variety of humanistic, educational, and budgeting perspectives, total district and school-by-school forecasts and forecasting models must be as accurate as possible. This paper reviews nine historical forecasting techniques, summarizes their major weaknesses, and identifies three modern methods applicable to school districts: the cohort-survival, percentage-survival, and graphic technique methods. Then the enrollment forecasting procedures at San Diego Unified School District (California) are discussed, including an unacceptable error rate for three forecasting years (1978-79, 1979-80, and 1980-81). Unpopular school closures and state-mandated school integration sparked efforts to combine forecasting techniques and information to produce more accurate forecasts. The present models are more precise. The total district forecast for 1982 had an error rate of 34; for 1983, the error rate was 1.9. Increased accuracy is also assured by the adjustment steps instituted for school-by-school enrollments. Planning procedures have been refined. The paper notes four model development considerations and advises districts to supplement formal forecasting methods with informal ones. (MLH)

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THE EVOLUTION OF A FORECASTING MODEL AND THE UTILITY FOR PLANNING IN A LARGE METROPOLITAN SCHOOL DISTRICT

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THE EVOLUTION OF A FORCASTING MODEL AND THE UTILITY FOR PLANNING IN A LARGE METROPOLITAN SCHOOL DISTRICT

For several decades now school districts have been in the business of planning for next year's students and, if possible, for the number of students within the next five to ten years. For the period of time from the mid-1940s to the present, year-to-year enrollment fluctuations have prevented district administrators from carrying out static planning. During the 1950s and 1960s, dramatic increases in total enrollments nationwide dictated that local school district officials learn to anticipate and plan for the increases. District administrators became proficient at providing a burgeoning school-age population with a wide-range of district services. Planning expertise was acquired for fast and efficient expansion of facilities and programs.

With the onset of population decline in the 1970s, districts were faced with a different set of planning problems. The total numbers available for school enrollment, on a national basis, were changing. These changes, which were necessitating shifts in program and facilities planning at the national level, were occurring in similar proportion in the population which made up local district attendance areas.[1] In addition to a decrease in total student population numbers, area stability also began to fluctuate. District officials became aware of a number of factors which resulted in changes in attendance area enrollment patterns. For one, as job opportunities varied, people moved into or

1 An attendance area ia a geographic section of the city designated by boundaries which provide a specific indication of residents who are to attend a given school.

out of a district in response to these fluctuations. Other factors such as available housing, shopping, recreational and educational facilities also were important in determining the total number of families attracted to an area. In addition to the building trends and job moves which caused shifts in student populations, students were found to transfer from public to parochial and private schools or, depending upon the times and circumstance, back from the private schools to public schools. Changes also occurred in enrollment patterns when students transferred from one public school to another or simply left school. In more recent times, formalized attempts to provide exchanges in student populations between schools within a district have come about as a result of desegregation decrees. All of these factors cause a continual shift in student population in any given district and make planning for future years' enrollments difficult.

Historical Forecasting Techniques

In response to these difficulties in planning, methods for predicting population numbers within districts as well as in individual school attendance areas were devised. Although no forecasting method yet produced can claim to provide complete accuracy in determining future enrollments, there are methods now available for many specific situations. In looking at the early work of forecasting, Holy (1946) and MacConnell (1957) were among the first to study and to use school enrollment forecasting methods. MacConnell (1957), basing his work on the work of Holy (1946), provides a listing of these methods and at the same time a sense of history of more modern methods.

MacConnell's (1957) list includes: 1) forecasting by analysis, 2) forecasting school enrollment from total population, 3) prediction based wholly on past census data, 4) method of analogy, 5) multiple factor method, 6) Bell Telephone Company's method of index analysis, 7) the "Law of Growth" principle, 8) projecting natural increase, and 9) a combination method.

The historical perspective can be obtained by considering each method briefly. Forecasting by analysis involves the use of percent of survivorship calculations on the past five years between the number of births and enrollment in kindergarten or first grade and between each of the grades. Future enrollments are calculated based on the five-year average for percent of survivorship. MacConnell's method for forecasting school enrollment from total population is based on the assumption that an observable ratio between total population and school enrollment exists and will hold good in the future. This ratio is calculated based on a ratio of total school enrollments to federal census for each of the previous two or three decades.

The method of predicting based on past census data assumes that the general population will reflect a total constant increase from one census year to the next and that the percentage rate of growth will vary from decade to decade. A curve is plotted showing percent of increase change in the past and the curve is extended to show future increases. The method has proven unreliable for forecasting.

The multiple factor method assumes that a prediction based on a number of social and economic factors which condition population growth is more reliable.

Factors which show a positive correlation with past changes in population are seen to affect population changes in the future. The mean of the increase of the factors over a period of years is used as a basis for predicting future population. Factors selected for use are those whose average increment of increase fall within one standard deviation of the mean increments of all the factors.

The Bell Telephone method utilizes telephone company determinations of persons per family and number of families for present estimates. Future estimates are produced on the basis of an established birth rate (births and deaths analyzed in relation to a known census figure) and a migratory factor, taking into account in-and-out migrations.

The Pearl-Reed Logistic Curve or "Law of Growth" principle utilizes a logistic curve and projects a constant for rate of increase or decrease. The method is subject to general errors and is most valid when used as a rough check for other methods.

As a means of determining population forecast trends, the method of analogy involves locating various larger cities and studying their populations at a point in time when their numbers equalled the present numbers of the city to be forecast. An inability to locate truly comparable communities produces differing variables in each of the communities and unreliable data.

The method of projecting natural increase is used to estimate current population and project natural increases and net integration for estimates of future

population. This method has proved reliable, particularly if U.S. census data by age groups is utilized.

A use of combination methods in the best of situations combines observations of developments within a community with the use of several mechanical projection techniques. As can be seen by the overview of each of these methods, the early methods, for the most part, provide only crude guides for predicting the future and have, therefore, been proven to be unreliable for forecasting. Their importance, however, lies in the fact that they have led the way to other more elaborate methods of forecasting.

Basic Forecasting Methods

Many of the early methods of forecasting were limited in usefulness and effectiveness due to their applicability in specific situations or to certain types of school districts. It is incumbent upon planners and administrators, then, to seek methods which offer more general applicability, or to employ a combination of methods which tailor the forecasting needs to the peculiarities of the district.

Shaw (1984) identified three methods offering general applicability, or universality, to school districts. These basic methods include the Cohort-Survival Method of Forecasting, the Percentage-Survival Method of Forecasting, and the Graphic Technique Method.

The Cohort-Survival Method can be used as a short-range (1-7 years) forecasting technique and encompasses the primary variables influencing enrollments such as

housing changes, employment fluctuations, in-migration, out-migration, retention, boundary changes, and births (usually calculated independently for kindergarten enrollments on the basis of past birth data). This method of forecasting is accomplished using the calculation of a series of survival rates which indicate the percentage of students progressing from one grade to the next. The ratio is calculated by dividing the enrollment in grade g at time t by the last year's enrollment in grade g-1 at time t-1. The Cohort-Survival Method relates to MacConnell's Forecasting by Analysis whereby an average of the historical survival rates (over a five-year period) is applied to current enrollments and provides the basis for projecting the trend of enrollments of the future (see Table 1). The survival rate ratio calculated as described above is multiplied by the present enrollment in grade g-1 at time t to forecast for grade g at time t+1.

TABLE 1

Grades 1-6 Grade Progressions for Any District (in percent)

Year	Grade 1-2	Grade 2-3	Grade 3-4	Grade 4-5	Grade 5-6
1979-80	91.6	106.8	100.6	96.0	88.2
1980-81	112.6	101.2	91.1	98.1	100.0
1981-82	91.1	97.9	95.8	96.5	96.7
1982-83	89.0	98.8	91.8	98.7	100.7
1983-84	95.8	99.3	94.2	100.0	95.5
Total five-year	480.1	504.0	473.5	489.3	481.1
Average	96.0	100.8	94.7	97.9	96.2

Projected Enrollments - Any District

Year	K	1	2	3	4	5	6	Total Elementary
1984-85	219	200	207	162	144	160	163	1,255
1985-86	197	180	192	209	153	141	154	1,226
1986-87	225	205	173	194	198	150	136	1,281
1987-88	194	177	197	174	184	194	144	1,264
1988-89	203	185	170	199	165	180	187	1,289

The Percentage-Survival Method utilizes procedures as in the Cohort-Survival Method with the exclusion of a kindergarten enrollment calculation based on birth data. Rather, with this method, future kindergarten enrollment is based

either on changes from year to year in the past or on an average from a base period of time. The judgment of school officials is used to determine the base period which best represents normal kindergarten enrollments. Smaller school districts or districts which do not have easy access to birth data find the Percentage-Survival Method an acceptable method for projecting enrollment.

The third universal method is the Graphic Technique Method. Simple linear regression is calculated for the pairs of years and enrollments in order to produce results which can be charted for the district as a whole. Individual grade enrollments are not calculated using this method. However, a forecasting advantage is offered by this method because of the ability to extend the forecast for a number of years into the future.

Forecasting Procedures at San Diego Unified School District

Prior to the early 1980s, enrollment forecasting procedures at San Diego Unified involved the application of one of the universal forecasting techniques, in isolation of other techniques, to school enrollment data. During school year 1981-82, however, a calculation of mean error rates (see Table 2) for the forecasting years 1978-79, 1979-80, and 1980-81 demonstrated that the error rates were in excess of acceptable levels, which is generally considered to be in a range between 6-7 for large school districts. These findings, in addition to changes in school district operations, including mandated procedures for school integration and a greater reliance on forecast figures for program and facilities planning and in instances of school closures, brought about an effort to combine forecasting techniques and information in order to produce more accurate forecasts.

TABLE 2

Mean Error Rates

Year	Mean Error Rates
1978-79	12.1
1979-80	7.5
1980-81	9.2

Precipitating Events

Since 1969, the district had been experiencing enrollment decline. By the late 1970s it was obvious that school sites in areas of diminishing populations would have to be closed. The closing of schools quickly became a political issue, and an immediate need for school forecasts became one of forecasting school attendance area population rather than that of forecasting school enrollments. The pressing need was to be able to determine if a given area would be capable of generating numbers of students to sustain the site (Criterion, 1982). As a result of the need for population forecasts, a forecast package was designed which was later adapted for enrollment forecasting within the district.

School Attendance Area Population Forecasts

The purpose of determining population forecasts is to be able to account for the number of students who can be expected to reside within each school attendance area boundary. Projections of residential population are relevant to discussions of a community's ability to supply sufficient students to justify a school's operation. School closures are most appropriately based on a comprehensive analysis of each area which appears to be experiencing population decline.

Forecasting Method

In order to gain the desired accuracy, a number of forecasting techniques were employed. Both the incidence of household growth or decline and the changing demographics of the population can affect the number of students per household. These factors were accounted for in the forecasting process through a model which utilized several projection techniques in sequence. These techniques included cohort progression, birthrate analysis, and housing growth analysis. (Criterion, 1982)

Cohort Progression

The basic forecasting technique, cohort progression (or cohort survival as described in an earlier section) was the first procedure used to project elementary attendance area student population. Students were assumed to progress from grade to grade based on historical grade progression rates determined for the period 1972 to 1981 (see Table 3). The average of the districtwide rates was calculated and applied to each school attendance area by grade. A value of 1.0 indicates that all students in a grade move to the next grade in the following year. From Table 3 it can be seen that grade progression rates for kindergarten to first grade are greater than one, indicating that some first grade students do not attend kindergarten.

TABLE 3

San Diego Unified School District

Grade Progression Rates for Elementary Grades

1972-1981

	K-1	1-2	2-3	3-4	4-5	5-6
1972-73	1.021	.973	.981	.988	.980	.994
1973-74	1.003	.993	.986	.977	.992	.996
1974-75	1.001	.966	.970	.979	.998	.990
1975-76	1.013	.959	.981	.975	.998	1.002
1976-77	1.017	.971	.975	.961	.990	.987
1977-78	1.018	.956	.971	.961	.990	.987
1978-79	1.008	.952	.966	.969	.972	.977
1979-80	1.027	.988	1.005	.991	.995	1.003
1980-81	1.064	.996	1.005	.981	1.007	1.008
Average	1.019	.973	.982	.978	.989	.995

Birthrate Analysis

An analysis of birthrate trends was carried out in conjunction with the cohort progression process. The number of births in any one year provides the basis for projecting the number of students who will be entering kindergarten five years later. Birthrate data was available by census tract designation (approximately 1,000 households) from the Department of Health. In order to use the census tract data to project kindergarten student numbers, census tracts were converted to attendance areas using approximation techniques. Based upon

the census tract conversion, a ratio of kindergarten students in 1981 to births in 1976 was determined for each attendance area. The ratio was applied to the number of births in these areas for 1977 through 1981 to project kindergarten enrollments for the years 1982 through 1986. Regression analysis was used to determine the historical trend.

Housing Growth Analysis

A third stage in the forecasting process was to incorporate information concerning housing growth. City of San Diego housing growth projections for 1985, 1990, 1995, and 2000 were utilized in conjunction with San Diego Association of Governments growth trends for the grid cells within the city. Using a computer procedure, attendance area boundaries were reconciled to the grid cell determination of housing projections. Projections were, therefore, obtained for the number of housing units within each school attendance area. An assumption about residents of the new housing was made on the basis of existing housing in each area--new residents were assumed not to vary in demographic characteristics from persons already living in the area. Current student-per-household rates were therefore applied to the projected number of housing units.

The type of information which was used to produce student projections for each school attendance area is shown in Table 4. A comparison listing of the projections of households for elementary school attendance areas is shown in Table 5. These student projections were central to determinations of the number and location of school closures.

TABLE 4

Abbreviated Listing of School Attendance Area Projection Data

School	Household Growth Pct Change 1980-85	1985-90	Students Per Household Actual 1981	Derived 1985	Births in Tracts Affecting Area 76	77	78	79
Adams	2.19	1.30	0.110	0.120	407	446	421	450
Audubon	3.05	0.00	0.526	0.550	247	271	289	310
Bay Park	8.35	0.05	0.095	0.067	79	105	98	111
Birney	5.91	8.51	0.059	0.063	279	305	285	315
Cadman	7.66	1.47	0.099	0.075	76	68	59	71
Chesterton	3.77	0.00	1.416	1.070	112	106	89	68
Crown Point	0.51	0.00	0.037	0.033	32	29	35	24
Darnall	15.57	0.00	0.328	0.344	98	104	79	82
Edison	2.20	4.09	0.117	0.130	280	313	316	338
Euclid	2.42	1.53	0.203	0.270	326	364	402	427

TABLE 5

Partial Listing of Projection of Households

for Elementary School Attendance Areas

School	School	Total Households			Household Change (%)	
Code	Name	1980	1985	1990	80-85	85-90
003	Adams	8304	8486	8596	2.19	1.30
009	Audubon	1442	1486	1486	3.05	0.00
021	Bay Park	3473	3763	3765	8.35	0.05
031	Birney	11911	12615	13689	5.91	8.51
043	Cadman	2088	2248	2281	7.66	1.47
061	Chesterton	398	413	413	3.77	0.00
073	Crown Point	8876	8921	8921	0.51	0.00
079	Darnall	912	1054	1054	15.57	0.00
089	Edison	4359	4455	4637	2.20	4.09
095	Euclid	5823	5964	6055	2.42	1.53

Planning Procedures at San Diego Unified School District

Procedures involving planning questions and strategies are generally tied to trends in population which have been translated into enrollments. In recent years, San Diego Unified School District has experienced steadily declining enrollments. In this period, questions have arisen concerning these trends. These questions include: Should schools be studied for closure and, if so, how should they be studied? Who should make the decision for closure? Related

planning questions include: How should attendance areas be divided among the school populations? What are the enrollment trends in areas of high minority population; of high majority population? How can questions of integration be addressed through enrollment distribution of ethnic populations? Where can special program populations be located? How can general program changes be made most effectively? And the most recent questions, as population trends have begun to turn around, have been: Where should we build new schools? How can they best be balanced ethnically?

There are a number of planning procedures in place at San Diego Unified School District. Some of the procedures, on a district level, address all of the questions above and apply them to specific situations. Other procedures, such as "cluster" committee studies (the study of school facilities utilization by community members), direct questions at a smaller unit of the total district population (the cluster of schools--elementary and junior high/middle which feed into a community high school) and apply them to a specific situation. San Diego Unified is in the unique position of having "cluster" areas with burgeoning student populations as well as "cluster" areas with dramatically declining student populations. "Cluster" studies and planning are carried out in instances of either enrollment increase or decline.

The specific needs of a "cluster" study as well as the more general needs of district planning studies have necessitated a new approach to the forecasting of school enrollments. Students may attend a "cluster" school for a variety of reasons: they may be attending the school because it is their neighborhood

school; they might be attending because it has a special education component; they may be attending the school because it is a "magnet" school offering a special enrichment program; they may be attending as a minority student in a majority school on the Voluntary Ethnic Enrollment Plan; or they may be attending on a special attendance permit for a variety of reasons, such as a babysitter who lives within the attendance area of the school. For whatever reason that students are enrolled in an individual school, the beginning of integration programs and other special programs provided a necessity to devise more accurate methods for forecasting enrollments and for predicting changes due to these special involvements. It became obvious that older forecasting methods which relied heavily on grade progression/cohort survival would have to be supplemented with updating versions allowing for strong influence from housing trends, special enrollment patterns, and special programs. Both general district planning and specific planning studies have necessitated that district enrollments be forecast, initially, on a total district basis and, secondly, by the "cluster" area unit.

Model Evolution

Following on the development of the models which were designed for school attendance area population forecasts, development was begun on models which could take factors such as demographic change and program change into consideration. During the first stage of model development, an analysis was performed of the cohort survival method currently in use as the model for the forecasting process. Error rates for the 1981-82 forecasts were calculated at

9.4. It was apparent that all of the forecasting variables were not being adequately accounted for by the model used. Efforts were made, therefore, to study the present method in relation to the demographics of the district in order to identify additional variables for model inclusion.

The Demographic Impact

San Diego Unified School District is an area of varying demographic trends. There are areas within the district in which the housing is "built-out" and the area continues to grow and to become more impacted with residents. There are areas in which the housing is "built-out" and the resident population has stabilized and has begun to decline. There are areas which are "built-out" but in which some of the older homes are being torn down and replaced with apartments and condominiums. These areas, too, continue to grow in population. There are areas which are ''building" and which will attract younger families and larger numbers of school-age population. There are areas which are "building'' but, because of the expense of the homes, will offer little in school-age population increase. Within the district, it is important to take these trends into account for forecasting purposes. It is also important to carry out a comprehensive analysis of birthrates and to account for varying birthrate trends.

Variable Inclusion in the Forecasting Model

Based on the model developed for forecasting attendance area populations, revised procedures were designed to incorporate variables reflecting cohort survival, birthrate trends and housing trend analysis into the model for school attendance area forecasting. An additional procedure was added to take into account attendance at special programs and additional variables relating to program attendance, including variables which might have been under-inflated or over-inflated.

Cohort Survival

The cohort survival forecasting technique was used as in the earlier model for population forecasting. Historical survival rates were calculated based on the traditional grade progression ratio: R gt = N g+1 t+1 / N gt (see Table 3).

Birthrate Trends

In addition to grade progression rates, trends in birth rates, or the kindergarten enrollment forecast, was obtained as in the original population model. Approximation techniques were used to convert birthrate data based on census tracts into school attendance areas. The kindergarten estimate was developed by calculating the average five-year birth to kindergarten ratio and applying it to the converted number of births within the district's attendance areas. The kindergarten model incorporated the regression of kindergarten enrollments on districtwide births which had been lagged five years. The resulting prediction equation was:

Kindergarten = 944 + (0.759 * Districtwide Births)

where births were lagged by five years.

Housing Trend Analysis

The housing analysis was produced on the basis of local housing agencies' housing projections. For each attendance area, households were assumed to have a demographic composition similar to the area's existing households. The result is that changes in the number of households are represented by proportional changes in the number of students. The projected number of households (for occupied housing units) is a net figure, taking into account both construction and demolition.

Forecast Adjustments

The student population of an area or the student enrollment in an area can change because of household growth or decline or because of a demographics change in the area, causing a change in the number of students per household. In addition, at San Diego Unified, enrollment patterns can be affected by changes in the integration programs (VEEP, magnet programs), alteration of special education placements, and recruiting and special efforts of individual principals and staff.

After preliminary forecasts have been produced, therefore, various procedures of a more manual and subjective nature can be used to refine the original data.

A first step is to cross-check the housing growth analysis. This is done by obtaining reports from principals and other community representatives on the most recent housing trends in the area. From forecasting experiences of the past, a combination of factors have worked to depress the growth of new housing in certain areas. This difference has been detected either by reports from local residents or from the release of more up-to-date housing projections. In any event, when changes are discovered, appropriate adjustments to the forecasts of the affected area are made.

Housing yield also is checked. The model assumes a constant pupil generation rate within areas. Should the general housing trend type be altered, for example, by the building of condominiums or townhouses, which offer much lower student generation rates than most single-family units, there is the risk of producing an inflated forecast. In instances where altered housing has been the

case, a pupil growth factor has been substituted into the forecasting process to compensate for the effects of overestimating pupil yield.

Other information which is acquired from principals or community members and agencies involves larger-than-normal changes in the public school/private school flow and changes in programs--for example, new programs that would draw students to the school (such as magnet, child care, new special education placement), or programs that are being moved from one school to another. The U.S. Navy is consulted for the Navy housing units rennovation schedule, as refurbishing of the housing units will result in a decrease in the number of students at a school and an increase when the units are reoccupied. The administrators of the special programs are also consulted to corroborate and to complete the change picture. Input of this sort is introduced into the forecasting process through adjustment on a school-by-school basis.

The decisions of citizens' study committees ("cluster" committees) on school closures, boundary changes, and program changes have an important impact on the annual forecasts. Preliminary forecasts are altered to reflect any changes which have resulted from a citizens' committee study.

A final step in the adjustment process takes the form of a central office review of the forecasts on a school-by-school basis. The review committee is made up of central office administrators who are involved with the schools either through budgetary responsibility or on the basis of school operations. During the meetings of this committee, the preliminary adjusted forecasts are reconciled with information which committee members contribute and with the principals' estimates of the coming year's enrollments.

Moving from Forecasts to District Planning

Once the adjustment and review phase is completed, the annual school-by-school forecast is "published" by presentation to the Superintendent's Cabinet. Acceptance of the forecast by the cabinet initiates district planning.

All staffing, facilities, and materials planning is based on annual school-by-school forecasts. Staffing allocations for the year are set depending upon the enrollment figure for each school. Should a school be showing a decline from the current year to the forecast year, there could be a release-for-transfer of teachers, or, "declaring of teachers in excess." Another example of forecast impact is in the instance when a school has gained in student population since the October baseline date, has staffed for that gain, yet the annual enrollment forecast does not indicate an increase for the next year. As there can be no certainty that the student increase will be retained by the next October, and as the forecast is not reflecting an increase, this situation also could result in teachers being declared in excess.

Facilities changes are based on the numbers of students forecast to be attending individual schools. Before additional classroom requests by programs such as magnet programs can be granted, portable classrooms must first be allotted for the enrollment needs at the school sites.

Planning for materials at the schools requires that the number of students expected at a school site, by grade, is known so that textbooks and other materials can be ordered and delivered to the sites by the opening of school.

In each area of planning, decisions involving large expenditures of funds are made based upon forecast figures. One portable classroom move alone costs $18,000. Rennovation and changes as necessitated by special programs are also costly. It is important to know with some assurance that the indicated availability of space at schools will remain so in order to allow for the special programs or that an indicated need for a move of portable classrooms onto sites is a real one and that students will materialize in the fall to fill them. It is also important to know that orders for textbooks, which are costly, will be accurately judged and that the costs involved in the arrangements to have the textbooks at the sites will provide appropriate numbers of texts at appropriate sites. Aside from strict monetary costs, many of which have not been mentioned, there are human and emotional costs involved in a failure to have staff on hand at schools where they are needed. In instances where demographic changes have not been properly anticipated and where more students enroll at a site than were forecast, both students and teachers must endure a period of oversubscribed classes until the official enrollment date for the semester has passed. The emotional situation is compounded if teachers have been declared in excess at that site during the previous year.

Summary

From the standpoint of the humanistic, educational, and monetary/budgeting perspectives, then, the total district forecast and the school-by-school enrollment forecasts must provide as great a degree of accuracy as possible. The models used to generate the forecasts, year after year, must be designed to provide as great a degree of precision as possible. Our models are now geared toward greater precision. The total district forecast for 1982 had an error rate of 3.4; for 1983, the error rate was 1.9. An increased degree of precision

also is assured by the adjustment steps which have been instituted for school-by-school enrollments. Planning procedures, both for enrollment forecasts and for general district planning, have been refined. These procedures have been designed and piloted and have now been put into practice. It is expected that they will provide the information needed for effective district planning. The absolute requirement of our evolutionary process was: 1) an expansion of the model to account for other variables, and 2) an institution of adjustment steps at the preliminary forecast stage in order to more carefully monitor recent demographic and program changes.

Should there be an interest by other districts in either developing forecasting models or refining existing ones, the following points should be taken into consideration:

1. Shaw (1984) compared three of the major forecasting methods and found that error scores varied depending on the size and location of the district and the method used. Each of the methods--Cohort-Survival, Percentage-Survival, and Graphic Technique--would be considered appropriate, depending on the size of the district, the type of data available, and the resources available for utilization of the methods.

2. More than one forecasting method can be used during the forecasting process. The use of a variety of methods can produce an ability to cross-check data and a greater degree of confidence in the end product.

3. In large school districts, the challenge becomes one of staying in touch with the changing nature of the demographics by individual area. This, in effect, means simulating a small school district's ease of access to information (Hockwalt, 1985). More careful methods of monitoring can be

accomplished by breaking down a district area into smaller units such as the Small Planning Units discussed by Bernhardt, Pullam and Graham (1983), by converting the small units into school attendance area units as in the San Diego method, or by various combinations and systems of feedback and monitoring, as in adjustment steps which can follow the generation of the preliminary forecasts.

4. Regardless of the size of the district, preliminary forecasts, on a school-school-by-school basis, should always be checked for face validity. This function is carried out by an interdivisional committee at San Diego Unified and by the superintendent and designated committee in small school districts (Hockwalt, 1985).

In essence, both past planning processes and current planning processes have involved either a use of forecasting models or a use of more subjective (although sometimes, arithmetical) procedures. It is time that we looked at combinations. There are now formal forecasting methods that can be used by districts of any size. As districts are faced with increasingly stringent budgetary constraints, it is strongly advised that a district, without respect to size, employ one or more formal forecasting methods. Conversely, but also without respect to size, it will be necessary for any district to devise a comprehensive network of feedback and cross-checks in order to provide the most accurate annual school-by-school forecast.

Historically, it has been the province of large school districts to employ statistical forecasting models. Small school districts have, for the most part, generated forecasts without the assistance of statistical models. it is obvious

to even the most casual observer that all school districts can benefit from the utilization of formal forecasting models. With the recent developments in microcomputers, forecasting in this manner is now possible for a district of any size. What has not been obvious, but which is of particular concern to larger districts, is the need to employ other methods in addition to their formal models. The work at San Diego Unified School District has shown that only when systematized, subjective processes are added will forecasts begin to assume a greater degree of accuracy on an annual basis and a greater degree of precision on a year-to-year basis.

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